Efficacy of a functional circuit class therapy on cardiac autonomic function, cognition and fatigue measures in type 2 diabetic individuals.

SHORT SYNOPSIS

Submitted in partial fulfillment of the requirement of the degree of

DOCTOR OF PHILOSOPHY

to

Manav Rachna International Institute of Research and Studies

(Deemed to be University)

by

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Registration number: 19/PhD/013

Under the supervision of

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Certificate

I hereby declare that the short synopsis "Efficacy of functional circuit class therapy on cardiac autonomic functions, cognition and fatigue measures in type-2 diabetic individuals" being submitted in partial fulfillment of the requirement for the degree of Doctor of Philosophy in Physiotherapy under Faculty of Allied Health Sciences of Manav Rachna International Institute of Research & Studies, Faridabad during the academic year 2022-2023

This is a bona fide record of original work carried out under the supervision of Prof (Dr.) Moattar Raza Rizvi and has not been submitted in full or part to any other university or institute for degree or diploma. Further, it is certified that short synopsis is plagiarism free and proof has been submitted.

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Abstract

Background/Introduction: Diabetes mellitus is accompanied by long-lasting consequences and symptoms, many of which are worsening and changing the physical and mental state of individuals affected. Chronic diabetes is linked to fatigue, mild to moderate cognitive impairment, and cardiac autonomic dysfunction. Mild to moderate intensity of exercise have shown to have good glycemic control. This study will examine the effect of functional circuit class therapy on type II diabetic individuals.

Aim : The aim of the study is to determine how functional circuit class therapy will affect cardiac autonomic functions, cognition and fatigue in type II diabetic individuals.

Methodology:Type II diabetic individuals(n=150) will be included in this study which will be further divided into two groups. Group 1(n=75) will be receiving functional circuit class therapy for eight weeks and Group 2(n=75) control group will receive basic education on physical activities. Pre and Post test will be done for outcome measure cardiac autonomic functions, cognition and fatigue.

Expected outcome: We expect the functional circuit class therapy to be an effective protocol to improve heart function, decrease fatigue and improve cognition.

Keyword: Diabetes, functional circuit class therapy, Heart rate variability, Fluid cognition

Introduction

Type 2 diabetes affects approximately 246 million individual worldwide and is thought to increase to 380 million by 2025 among which a total of 7.1% of adult population are affected (International diabetes foundation 2006). According to Mohan et al. 2008, India is the capital of diabetic individuals.The cohort study of more than 1300 adults with type II diabetes reported the direct connection between prevalence of symptoms and survival rate (Sudore et al.2012).

Diabetes mellitus is associated with prolonged manifestation and symptoms, many are debilitating and alter the physical and mental health. Type 2 diabetes is common form which is basically the combination of insuffeciency in insulin secretion and insulin action either of which may prevail. Diabetes is characterized by chronic hyperglycemia and the diabetes specific microvascular pathology leading to various types of neuropathies and aslo nephropathies. When pacncreatic beta islets cell function is compromised, there is insufficient insulin secretion, which causes the liver to overproduce glucose and peripheral tissues to use glucose insufficiently(Tripathi and Srivastava,2006).

Diabetic autonomic neuropathy (DAN) is a serious common complication of diabetes which is often ignored and missed. It includes arrhythmias, silent myocardial ischemia and sudden death and is related to other microangiopathic comorbidities. Cardiac autonomic neuropathy is manifestation of diabetic autonomic neuropathy and is defined as impairement of autonomic control of cardiovascular system. A recent crosssectional study on 387 diabetic individuals reported the trend of increased inclination of having cardiac autonomic neuropathy with increased resting heart rate and highlighted the importance of resting heart rate as a predictive value of cardiac autonomic neuropathy (Alberto et al. 2014).

The other complication of diabetes is fatigue. In patients with T2DM, fatigue has been associated with depression and diabetes distress (Fritschi et al. 2012).The subjective perception of a declining ability to perform physical or mental tasks as a result of one or more physiological, psychological, or lifestyle phenomena, due to variations in glucose control, symptoms of diabetes, emotional distress from diabetes, depression, inactivity, and BMI, is referred to as fatigue

(Fritschi and Quinn et al.(2010).In diabetic population, fatigue is prevalent but not thoroughly examined.

Patients with diabetes often experience fatigue, and type 2 diabetic patients seem to experience this symptom more frequently than type 1 diabetic patients do. One aspect of type 2 diabetes that may add to the sensations of fatigue is chronic inflammation (Lasselin et al 2012). Individual with type 2 diabetes has various lifestyle issues like lack of physical activities, higher body mass index which is also the contributor of fatigue (Telford 2007). The depression resulting from the detection of diabetes can also result in fatigue (Katon et al. 2004).

Diabetes is linked to long-term brain issues, which manifest as decreased cognitive function and more abnormalities on brain imaging when compared to persons without diabetes.Although it has not consistently been seen that glycemic management appears to play a role in determining the level of cognitive dysfunction in people with type 2 diabetes (Watson et al 2003). Type 2 diabetes is also linked with altered cognitive function Cukierman T at al.2005. Various studies done on type 2 diabetic individuals suggests decline in reminiscence, decision making and processing of information (van den Berg E et al. 2006). These changes in cognitive function are linked with atrophy and vascular lesions in brain as seen in magnetic resonance imaging (Manschot SM et al.2006).

Recent studies have shown the positive impact of exercises in type 2 diabetes and advocated the long term exercise programme for the management as well as prevention of common metabolic disease.There has been substantial benefit of exercises as documented in Diabetes Care 2002. Functional circuit class therapy is a tailored made exercise which is performed in different stations by 2-3 individuals together. Effect of circuit class therapy has been studied on various populations like stroke survivor and cerebral palsy etc. but there is paucity of literature in type 2 diabetes mellitus individuals. So the current study will examine the effect of functional circuit class therapy on cardiac autonomic function, fluid cognition and fatigue measures.

Aim

To investigate the effect of functional circuit class therapy on cardiac autonomic dysfunction, cognition and fatigue measures in individual with T2DM.

Objective

- To assess the change in cardiac autonomic function among type 2 diabetic individuals following the functional circuit class therapy.
- To evaluate the change in the cognitive function in the type 2 diabetic individuals after the functional circuit class therapy.
- To investigate the effect of functional circuit therapy on fatigue in individuals with type 2 diabetes.

Hypothesis

Experimental hypothesis

- There will be significant effect of functional circuit class therapy on cardiac autonomic function in individuals with T2DM.
- There will be significant effect of functional circuit therapy on fluid cognition in individuals with T2DM.
- There will be significant effect of functional circuit therapy on fatigue in individuals with T2DM.

Null hypothesis

- There will be no effect of functional circuit class therapy on cardiac autonomic function in individuals with T2DM.
- There will be no effect of functional circuit therapy on fluid cognition in individuals with T2DM.
- There will be no effect of functional circuit therapy on fatigue in individuals with T2DM.

Significance of the study

- The functional circuit class therapy(FCCT) may be used an alternative to conventional therapy for diabetic individual. If the effectiveness of functional circuit class therapy (FCCT) in reducing fatigue is prooved than these patients can be taught the energy pacing techniques to avoid fatigue related decrease in daily activity.
- In addition to this if the cardiac autonomic dysfunction is ascertained at early stage of diabetes then further complication like myocardial infarction cardiac arrest and other heart related health issues can be controlled.
- If effect on fluid cognition is found then the protocol can be applied to individuals with mild to moderate cognitive deficit.

Operational Definitions of the variables

- **Functional circuit class therapy**

It is defined as the therapy provided to more than 2 participants, involving a tailored intervention program, with focus on practice of functional tasks received within group setting, provided to participants with similar or different degrees of functional ability; and involving therapist to patient ratio no greater than 1:3 (Coralie . English,et al.2007)

- **Fluid Cognition:**

Fluid cognitive functioning can be thought of as all purpose cognitive processing not necessarily associated with any specific content domain and as involving the active or effortful maintenance of information, whether verbal or visual-spatial in working memory for purposes of planning and executing goal directed behavior (Baddeley 1986; Kane & Engle 2002).

Review of Literature

According to International Diabetes Foundation it is estimated that by 2040 approximately 640 million people are thought to be diabetic worldwide.The estimated prevalence of diabetes is expected to be twice in next twenty years as stated by I dash because of increased age obesity.

By examining heart rate variability (HRV) and heart rate recovery (HRR), one can assess the autonomic nervous system's (ANS) ability to control homeostasis (Akselrod et al 1989). Diabetes-related cardiac autonomic neuropathy causes a reduction in HRV, which is now one of the most effective predictors of death (Rovere et al. 1998). Finding a cost-effective solution to prevent or reduce cardiac autonomic neuropathy (CAN) progression in type 2 diabetic individuals is a significant problem for primary care providers given its link with cardiovascular disease and death. Exercise appears to be a quick, low-cost treatment for autonomic dysfunction in Type 2 Diabetes. The majority of the studies in the current evaluation showed beneficial changes after exercise training. Studies on the paravertebral and prevertebral sympathetic ganglia, which exhibit segmental myelin loss and varying axonal degeneration of neuron in the rami communicates, are more common (Locke et al 1965).

Furthermore there are studies comparing the effects of circuit class therapy and individual physiotherapy treatments on stroke survivors capability to walk and maintain functional balance confirmed that circuit class therapy is equally efficient (Hillier et al,2007). Another study suggest that functional exercise training can improve mobility in overweight/ obese individual with diabetes (Kimberlee et al. 2018).

Heart Rate Variability(HRV):

Among all the techniques, HRV analysis has emerged as a simple, non-invasive method for assessing the sympatho-vagal balance at the sinoatrial stage.The fluctuations in the time between consecutive heartbeats (R-R interval) is referred to as HRV.

The HRV analysis measures successive sinusoidal RR interval fluctuations and uses the data to determine the autonomic tone. Numerous variables, such as gender, age, circadian rhythm, respiratory rate, and body position, have an impact on HRV biologically. Quick, painless, and highly reproducible are the characteristics of HRV. HRV is frequently used in the field of dynamic electrocardiography, they can be carried out utilising 24-hour Holter records or at shorter time intervals of 0.5 to 5 minutes.HRV is a reliable tool which is sensitive and non-invasively

measures the autonomic input to the treatment. Clinically HRV is likely to recognise the patients at high risk and can also give insight about the effect of therapies on patients (Phyllis.K.Stein et al.1994)

Functional Circuit Class Therapy:

Exercises is one of the basic Strategies for glycemic control as it increases the sensitivity towards insulin in tissues. Along with good glycemic control it has effect in lipid profile,blood pressure and the psychological effects including improvement in depression. The effectiveness of exercises is based on the type of exercises like aerobic training is more effective than strength program as reported by Petrella, & Chudyk, (2008). The exercise of moderate intensity which is 40%-60% of aerobic capacity which is equivalent to 55%-69% of maximum heart rate is recommended for individual with type 2 diabetes as the sensitivity and glucose tolerance is maintained for above 12 - 24 hours . The frequency to be kept at three days per week to maintain the same. The aerobic exercises should be performed 2 to 3 times a week. Each session should include 5 to 10 exercises targeting a large muscle group (Colberg SR, et al.2010)

Autonomic nervous system is majorly affected by various systemic illnesses including diabetes mellitus. Diabetic autonomic neuropathy leads to motor and sensory function in the cardiovascular system including the reflex related to it. Study done by Ewing at al 1985, concluded that diabetes have a increased heart rates and resting tachycardia as unreliable marker of autonomic neuropathy.

The cardiac symptoms associated with diabetes includes reduced heart rate variation during deep breath increase in length of QT interval, sometimes associated resting tachycardia altered exercise tolerance and reduced baroreflex sensitivity (Pop-Busui 2014).

Another prevalent manifestation in diabetes is fatigue, which is the resultant of hypoglycemia and hyperglycemia and the variation between the two as reported by Morsch et al 2006. Khurana et al 2010 reported that fatigue can also be the resultant of complication related to various agent medication used in diabetes. Telford Rd 2007 Reported that reduced physical activity and increased weight is also a common manifestation for fatigue in type 2 diabetic individuals. The

prevalence of fatigue is considered to be 61% in type 2 diabetes as concluded by Drivsholm T 2005. Further it is has been reported in one of the previous study that type 2 diabetic individulas have higher level of fatigue (Singh et al. in 2013)

Diabetes mellitus is associated with altered cognitive function (Moheet at al,2015). Both type 1 and type 2 diabetic individuals experience mild to moderate cognitive deterioration. Dementia risk has increased by 50% in people with type 2 diabetes (Biessels, G. J et all 2006).Recurrent episodes of hypoglycemia has been important contributor for cognitive dysfunction in type 2 diabetic individuals treated with insulin.The Other risk factor includes the inflammatory mediators, rheological factors and dysregulation of hypothalamic pituitary adrenal axis (Deary I et all 1996).

The individuals having increased level of glycosated haemoglobin (HbA1c) shows fatigue which is indirectly related to glucose control. An association between poor glucose control and diabetic symptoms and distress have been reported in a quantitative research in type 2 diabetic individuals (Hanjong Park at al 2015).

Circuit training is a multifaceted tool that is done in various stations at the same time . It also has a great impact on cardiovascular function as reported by various studies. An increase in VO_2 Max from 15% to 18.6% is reported in post menopausal women after 245 weeks of circuit training (Brentano et al 2008).

Procedure

Methodology

Study design: Randomized controlled trial.

Sampling Technique: Convenience sampling technique will be used in this study.

Sample Size: 75 experimental group and 75 control group

The number of subjects is determined by G power 3.1.9 version considering the six-minute walk test from study done by Kimberlee et al. 2018. Seventy five(n=75) subjects in each group including 10% of dropout will be taken for the study. Based on the effect size 0.382, alpha level 0.05 and power 0.80 a sample of size of total 150 will be evaluated out of which Seventy five(n=75) will be taken to assess the impact of functional circuit class therapy on cardiac autonomic function, fluid cognition and fatigue measures.

Inclusion Criteria

- Type 2 diabetes more than 12 months and less than 5 yrs
- BMI less than 29.9 kg/m^2
- HbA1c more than 6.5
- Age group 35 to 45 years
- Oral medication or without medication
- Ability to walk for 20 minutes without any assistance
- Patient were included if they did not engage in physical exercise for more than 20 minutes

Exclusion criteria

- Liver impairment
- Neuropathy
- Retinopathy
- Renal insufficiency (Creatinine level more than 2mg/dl)
- Others neurological pathology
- Musculoskeletal disorder
- History of any surgery
- History of presence of cardiac or respiratory Pathology

Variables

Independent variables:

- Functional circuit class therapy

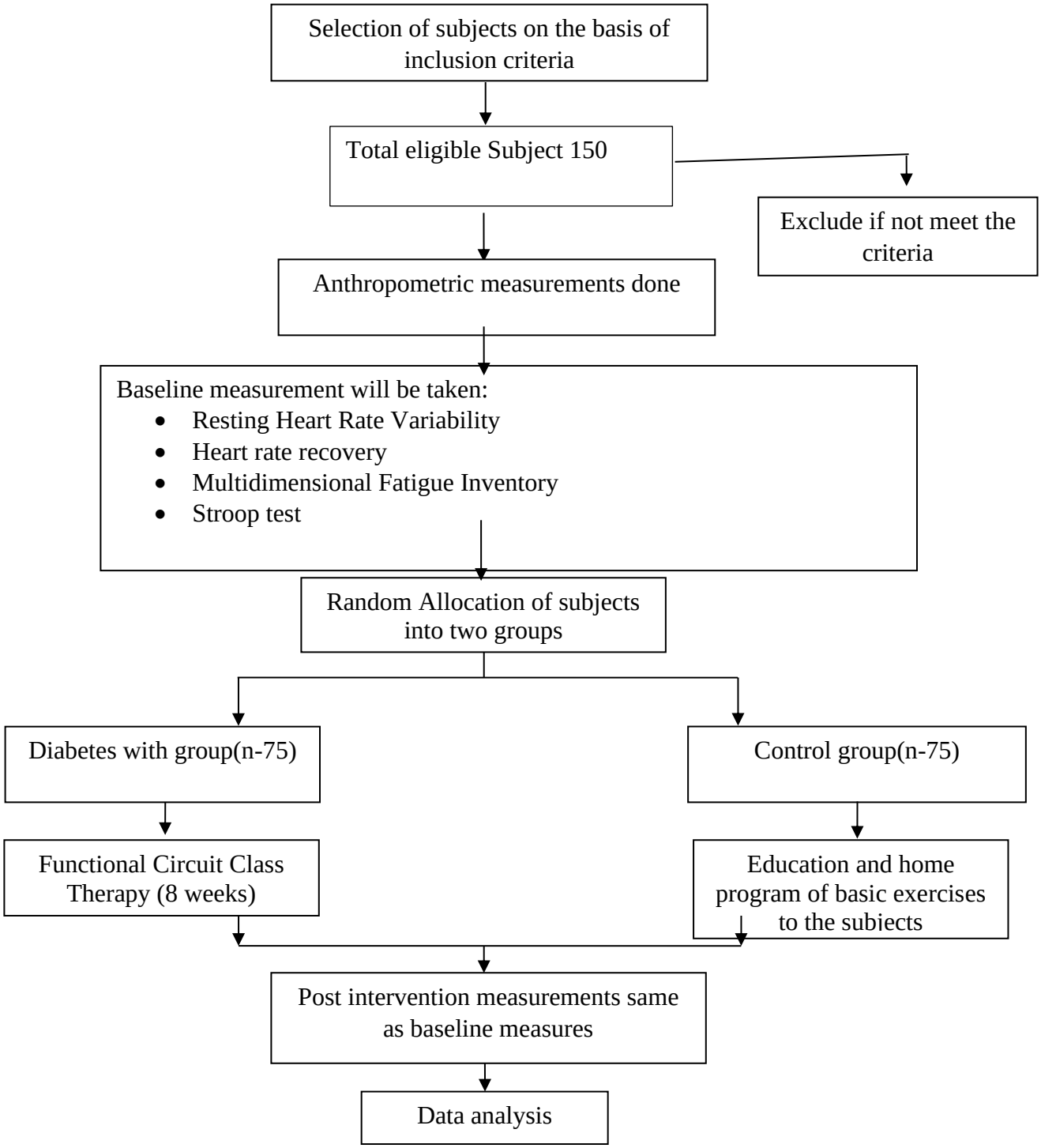
Dependent Variable:

- Body composition
  - Body mass index
- Metabolic profile
  - Blood glucose level
  - Glycosylated haemoglobin (HbA1c)
- Cardiac autonomic functions
  - Resting Heart Rate Variability
  - Heart rate recovery
- Cardiac functions
  - Heart rate
  - Blood pressure
- Fatigue measures
  - Multidimensional Fatigue Inventory
  - Fatigue severity scale
- Cognitive function
  - Stroop test

EQUIPMENTS

- Weighing machine
- Stadiometer
- Sphygmomanometer
- Glucometer
- Spectrophotometer
- AD instruments power lab with HRV module
- Multidimensional fatigue inventory-20
- Fatigue severity scale
- Stroop test for adults

STUDY DESIGN


Selection of subjects on the basis of inclusion criteria
Total eligible Subject 150
Exclude if not meet the criteria
Anthropometric measurements done
Baseline measurement will be taken:
Resting Heart Rate Variability
Heart rate recovery
Multidimensional Fatigue Inventory
Stroop test
Random Allocation of subjects into two groups
Diabetes with group(n-75)
Control group(n-75)
Functional Circuit Class Therapy (8 weeks)
Education and home program of basic exercises to the subjects
Post intervention measurements same as baseline measures
Data analysis

Protocol for data collection

"Subjects of Type 2 diabetes will be recruited from clinics and hospitals of Delhi NCR, on the basis of inclusion and exclusion criteria. Subjects will be informed about the study. They will be explained about the detail purpose, methodology and possible risk during the study. They will be given an informed consent form to sign and explaining their rights as research subjects. Ethical clearance will be obtained from institutional ethical committee, Manav Rachna International Institute of Research and Studies before starting the work. All identifying information on the consent form and demographic/injury history questionnaire will be kept confidential by assigning a number to each subject.

Subject who meet the eligibility criteria will be further classified into two groups: Group 1 includes subjects with Type II Diabetes Mellitus which will get 8 weeks of functional circuit class therapy and Group 2 will be control group which will receive basic education regarding physical activities."

EVALUATION

First evaluation will be included descriptive information such as age, sex, height, weight, body mass index (BMI), diabetic history.

Subjects will be assessed for blood glucose level(random blood glucose) through glucometer and glycemic control through glycosated haemoglobin(HbA1c).

Subjects will be evaluated for cardiac autonomic function by using HRV(AD instruments power lab) with heart rate variability module.

The cardiac function will be assessed for heart rate and blood pressure.

The multidimensional fatigue inventory-20 and fatigue severity scale will be filled before the training.

The individuals will be assessed for cognitive function using Stroop test.

Criterion measures

Body mass index (BMI)

"Bodyweight will be measured to the nearest two decimal (in kilogram) and height to the nearest one decimal (centimetre); both will then be used to calculate BMI (kg/m^2) (Oliveira et al. 2012)"

Blood glucose

"Fasting and postprandial blood glucose level will be measured from venous blood samples using the glucose oxidase method (Ng et al., 2010)"

Glycosylated haemoglobin (HbA1c)

"Participants who fasted for at least 10 hours the night before will have 10 ml of blood taken from them and analysed in order to determine their HbA1c levels. Using high-performance liquid chromatography, HbA1c will be assessed (HPLC) (Kadoglou et al., 2013)."

Fatigue

Fatigue will be measured by a Multidimensional fatigue inventory questionnaire and Rate of perceived exertion.

Fluid Cognition

"Cognitive, or executive, control refers to the ability to coordinate thought and action and direct it toward obtaining goals. It is needed to overcome local considerations, plan and orchestrate complex sequences of behavior, and prioritize goals and subgoals.Miller E K and Wallis J D (2009)It will be measured by Stroop test."

Stroop Test

"The Stroop Test, also known as the color-word naming test, has been used in over sixty published psychological studies since the test was originally described by Stroop (2). The test has been used to attempt to measure a variety of processes and traits in the cognitive and personality domains.（Stroop, J. R., 1935)"

Cardiac autonomic function:

“Influence of sympathetic and parasympathetic nervous system over heart.The cardiovascular system is significantly regulated by the autonomic nervous system (ANS). In the near term, it controls blood pressure and heart rate to deal with challenges. Heart rate and cardiac contractility are decreased by parasympathetic (vagal) regulation, whereas sympathetic branch activity counteracts these effects and controls peripheral vasoconstriction.(Hägglund H et al 2012)”

Training and intervention

Type of exercise	**Volume and frequency**
Week 1/2 Activation of muscles and building movement with control. the training program is targeting whole body including cardiovascular exercise. The circuit is formed in such a way to help the body in conditioning and preventing from exertion and fatigue. Each exercise is performed 30 sec during training with interval of 1 minutes between exercise. Patient has to perform maximum number of repetition. "Jumping jack (total body) Wall sit hold(lower body) Push up hold (upper body) Crunch hold(core) Step up (total body) Squat(lower body) Triceps dip (upper body) Plank (core) High knees (total body) Lunges (lower body) Push up with rotation(upper body) Side plank(core)"	**Number of set-2** 3 days/week The repetition and performance time noted and interval break between exercise decreased by 15 second after every 6 session. Also 1 set of exercise is added as progression.
Week 3/4 Each exercise is performed 30 second during training with interval of 45second between exercise. Patient has to perform maximum number of repetition. "Jumping jack (total body) Wall sit hold(lower body) Push up hold (upper body) Crunch hold(core) Step up (total body) Squat(lower body) Triceps dip (upper body) Plank (core) High knees (total body) Lunges (lower body) Push up with rotation(upper body) Side plank(core)"	**Number of set-2** 3 days/week The repetition and performance time noted and interval break between exercise decreased by 15 second after every 6 session. Also 1 set of exercise is added as progression
Week 5/6 Each exercise is performed 30 second during training	**Number of set-3**

with interval of 30 second between exercise. Patient has to perform maximum number of repetition. "Jumping jack (total body) Wall sit hold(lower body) Push up hold (upper body) Crunch hold(core) Step up (total body) Squat(lower body) Triceps dip (upper body) Plank (core) High knees (total body) Lunges (lower body) Push up with rotation(upper body) Side plank(core)"	3 days/week The repetition and performance time noted and interval break between exercise decreased by 15 second after every 6 session. Also 1 set of exercise is added as progression
Week 7/8 Each exercise is performed 30 second during training with interval of 15 second between exercise. Patient has to perform maximum number of repetition. "Jumping jack (total body) Wall sit hold(lower body) Push up hold (upper body) Crunch hold(core) Step up (total body) Squat(lower body) Triceps dip (upper body) Plank (core) High knees (total body) Lunges (lower body) Push up with rotation(upper body) Side plank(core)"	**Number of set- 3** 3 days/week The repetition and performance time noted and interval break between exercise decreased by 15 second after every 6 session. Also 1 set of exercise is added as progression

Proper warm up and cool down routine will be performed before and after the training.

Active range of movements with 10 repetition will be used as dynamic warm up and static stretching's as cool down .

References

Biessels, G. J., Staekenborg, S., Brunner, E., Brayne, C., & Scheltens, P. (2006). Risk of dementia in diabetes mellitus: a systematic review. The Lancet Neurology, 5(1), 64-74.

Brentano MA, Cadore EL, Da Silva EM, Ambrosini AB, Coertjens M, Petkowicz R, Viero I, Kruel LF. Physiological adaptations to strength and circuit training in postmenopausal women with bone loss. J Strength Cond Res. 2008;22(6):1816-1825.

Chudyk A, Petrella RJ. Effects of exercise on cardiovascular risk factors in type 2 diabetes: a meta-analysis. Diabetes Care 2011; 34: 1228-1237 [PMID: 21525503 DOI: 10.2337/dc10-1881]

Colberg SR, Sigal RJ, Fernhall B, Regensteiner JG, Blissmer BJ, Rubin RR, Chasan-Taber L, Albright AL, Braun B. Exercise and type 2 diabetes: the American College of Sports Medicine and the American Diabetes Association: joint position statement. Diabetes Care 2010; 33: e147-e167 [PMID: 21115758 DOI: 10.2337/ dc10-9990].

Cukierman, T., Gerstein, H. C., & Williamson, J. D. (2005). Cognitive decline and dementia in diabetes—systematic overview of prospective observational studies. Diabetologia, 48(12), 2460-2469.

Drivsholm T, de Fine Olivarius N, Nielsen AB, Siersma V. Symptoms, signs and complications in newly diagnosed type 2 diabetic patients, and their relationship to glycaemia, blood pressure and weight. Diabetologia 2005.

English, C. K., Hillier, S. L., Stiller, K. R., & Warden-Flood, A. (2007). Circuit class therapy versus individual physiotherapy sessions during inpatient stroke rehabilitation: a controlled trial. Archives of physical medicine and rehabilitation, 88(8), 955-963.

Ewing, D. J., Martyn, C. N., Young, R. J., and Clarke, B. F. (1985). The value of cardiovascular autonomic function tests: 10 Years experience in diabetes. Diabetes Care 8, 491–498.

Fritschi C. & Quinn L. (2010) Fatigue in patients with diabetes: a review. Journal of Psychosomatic Medicine 69(1), 33–41.

Fritschi, C., Quinn, L., Hacker, E. D., Penckofer, S. M., Wang, E., Foreman, M., & Ferrans, C. E. (2012). Fatigue in women with type 2 diabetes. The Diabetes Educator, 38(5), 662-672.

Gretebeck, K. A., Blaum, C. S., Moore, T., Brown, R., Galecki, A., Strasburg, D., ... & Alexander, N. B. (2019). Functional exercise improves mobility performance in older adults with type 2 diabetes: a randomized controlled trial. Journal of Physical Activity and Health, 16(6), 461-469.

Katon W, von Korff M, Ciechanowski P, et al. Behavioral and clinical factors associated with depression among individuals with diabetes. Diabetes Care. 2004;27(4):914-920.

Khurana R, Malik IS. Metformin: safety in cardiac patients. Postgrad Med J. 2010;86(1016):371 373.

Lasselin, J., Layé, S., Dexpert, S., Aubert, A., Gonzalez, C., Gin, H., & Capuron, L. (2012). Fatigue symptoms relate to systemic inflammation in patients with type 2 diabetes. Brain, behavior, and immunity, 26(8), 1211-1219.

Manschot SM, Brands AMA, van der Grond J, Kessels RPC, Algra A, Kappelle LJ, Biessels GJ. Brain magnetic resonance imaging correlates of impaired cognition in patients with type 2 diabetes. Diabetes 2006;55:1106–1113.

Mohan, V., Mathur, P., Deepa, R., Deepa, M., Shukla, D. K., Menon, G. R., ... & Shah, B. (2008). Urban rural differences in prevalence of self-reported diabetes in India—The WHO–ICMR Indian NCD risk factor surveillance.*Diabetes research and clinical practice*, *80*(1), 159-168.

Moheet, A., Mangia, S., & Seaquist, E. R. (2015). Impact of diabetes on cognitive function and brain structure. Annals of the New York Academy of Sciences, 1353(1), 60-71.

Morsch CM, Goncalves LF, Barros E. Health-related quality of life among haemodialysis patients—relationship with clinical indicators, morbidity and mortality. J Clin Nurs 2006;15:498–504.

Park, H., Park, C., Quinn, L., & Fritschi, C. (2015). Glucose control and fatigue in type 2 diabetes: the mediating roles of diabetes symptoms and distress. Journal of advanced nursing, 71(7), 1650-1660.

Pop-Busui, R. (2010). Cardiac autonomic neuropathy in diabetes: a clinical perspective. Diabetes care, 33(2), 434-441.

Singh, R., & Kluding, P. M. (2013). Fatigue and related factors in people with type 2 diabetes. The diabetes educator, 39(3), 320-326.

Strachan, M., Reynolds, R., Marioni, R. et al. Cognitive function, dementia and type 2 diabetes mellitus in the elderly. Nat Rev Endocrinol 7, 108–114 (2011). https://doi.org/10.1038/nrendo.2010.228

Sudore, R. L., Karter, A. J., Huang, E. S., Moffet, H. H., Laiteerapong, N., Schenker, Y., ... & Schillinger, D. (2012). Symptom burden of adults with type 2 diabetes across the disease course: diabetes & aging study. Journal of general internal medicine, 27(12), 1674-1681.

Telford RD. Low physical activity and obesity: causes of chronic disease or simply predictors? Med Sci Sports Exerc. 2007;39(8):1233-1240.

Tripathi, B. K., & Srivastava, A. K. (2006). Diabetes mellitus: complications and therapeutics. Med Sci Monit, 12(7), 130-47.

Van Den Berg, E., Reijmer, Y. D., de Bresser, J., Kessels, R. P., Kappelle, L. J., & Biessels, G. J. (2010). A 4 year follow-up study of cognitive functioning in patients with type 2 diabetes mellitus. Diabetologia, 53(1), 58–65.

Verrotti, A., Prezioso, G., Scattoni, R., & Chiarelli, F. (2014). Autonomic neuropathy in diabetes mellitus. Frontiers in endocrinology, 5, 205.

Vinik AI, Erbas T, Casellini CM. Diabetic cardiac autonomic neuropathy, inflammation and cardiovascular disease. J Diabetes Investig 2013; 4: 4-18 [PMID: 23550085 DOI: 10.1111/jdi.12042]

Watson, G., & Craft, S. (2003). The role of insulin resistance in the pathogenesis of Alzheimer's disease. CNS drugs, 17(1), 27-45.

Efficacy of a functional circuit class therapy on cardiac autonomic function, cognition and fatigue measures in type 2 diabetic individuals

by Sunita Kumari

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SHORT SYNOPSIS

by

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Expected outcome: We expect the functional circuit class therapy to be an effective protocol to improve heart function, decrease fatigue and improve cognition.

Keyword: Diabetes, functional circuit class therapy, Heart rate variability, Fluid cognition

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Title: Efficacy of functional circuit class therapy on cardiac autonomic function cognition & fatigue measure in type 2 diabetic individual.

Researcher: Sunita Kumari Registration Number: 19/PhD/013

Supervisor: Prof (Dr.) Mohtesham Raza Rizvi Department: Physiotherapy

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